HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus

for

M.Tech CSE

(Two Years Program Spread Over Four Semesters)

As per National Education Policy (NEP-2020)

(w.e.f. the Academic Year 2023-2024)

Department of Engineering & Technology
School of Computer Science & Engineering

Approved by the Board of Studies

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1. Preamble

M.Tech (CSE) program is named as Master of Technology in Computer Science and Engineering. The syllabus for this program is framed under NEP-2020 with core, elective (discipline specific and value added) and other interdisciplinary courses incorporated as its components following the University Grants Commission (UGC) guidelines. Department of Computer Science also made an attempt to revise the curriculum of M.Tech (CSE) in alignment with National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. With NEP-2020 in background, the revised curricula articulate the spirit of the policy by emphasizing on integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and Constitutional values through value-based courses. The NEP-2020 also enables the students to select subjects as per their interest. Also, diverse lab experiments as well as field visits/demonstrations allow students to understand the fundamental aspects of the subject. This program is relevant to young students/ professionals who are looking to develop their analytical and research skills regarding important issues in computer science. Furthermore, continuous assessment is an integral part of the NEP-2020, which will facilitate systematic and thorough learning towards better understanding of the subject.

2. Program Objectives (POs)

Apply the knowledge of mathematics and computing fundamentals to various real-life applications for any given requirement. Design and develop applications to analyse and solve all computer science related problems. This is accomplished through the following learning goals and objectives:

- **Knowledge of mathematics and computing fundamentals**. Apply the knowledge of mathematics and computing fundamentals to various real-life applications for any given requirement.
- **Design and develop applications**. Design and develop applications to analyse and solve all computer science related problems.
- **Effective Communication**. Students will use various forms of business communication, supported by effective use of appropriate technology, logical reasoning, and articulation of ideas. Graduates are expected to develop effective oral and written communication especially in business applications, with the use of appropriate technology (business presentations, digital communication, social network platforms and so on).
- **Leadership and Teamwork**. Students will acquire skills to demonstrate leadership roles at various levels of the organization and leading teams. Graduates are expected to collaborate and lead teams across organizational boundaries and demonstrate leadership qualities, maximize the usage of diverse skills of team members in the related context.
- **Global Exposure and Cross-Cultural Understanding**. Graduate will be able to demonstrate a global outlook with the ability to identify aspects of the global business and Cross -Cultural Understanding.
- **Integrate and apply efficient tools**. Integrate and apply efficiently the contemporary IT tools to all computer applications.
- **Designing innovative methodologies**. Create and design innovative methodologies to solve complex problems for the betterment of society.
- **Applying inherent skills**. Apply the inherent skills with absolute focus to function as a successful entrepreneur.

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• **Social Responsiveness and Ethics**. Students will demonstrate responsiveness to contextual social issues/ problems and exploring solutions, understanding ethics, and resolving ethical dilemmas. Demonstrate awareness of ethical issues and can distinguish ethical and unethical behaviour.

3. Program Learning Outcomes (PLOs)

The main outcomes of the CSE (M.Tech.) program are given here. At the end of the program a student is expected to have:

- An understanding of the theoretical foundations and the limits of computing.
- An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems.
- An ability to design, develop and evaluate new computer-based systems for novel applications which meet the desired needs of industry and society.
- Understanding and ability to use advanced computing techniques and tools.
- An ability to undertake original research at the cutting edge of computer science & its related areas.
- An ability to function effectively individually or as a part of a team to accomplish a stated goal.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively with a wide range of audience.
- An ability to learn independently and engage in lifelong learning.
- An understanding of the impact of IT related solutions in an economic, social and environment context.

4. Curriculum Structure

M.Tech degree, two years PG programme will have a curriculum with Syllabi consisting of following type of courses:

- **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of the study is referred to as Discipline Specific Elective.
- **Value addition, Skill Enhancement & Inter Departmental Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/interdepartmental subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's values/proficiency/skill is called an Elective Course. These courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills and to improve the employability skills of students.

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5. SCHEME OF EXAMINATION

The pass percentage in each subject will be 40%.

- **Theory Examination**
  Irrespective of credits, each paper will be of 100 marks (60 marks for theory exam and 40 marks for internal assessment) and duration of paper will be 3 hours.
- **Practical Examination**
  Each paper will be of 100 marks (60 marks for external practical exam and 40 marks for internal assessment) and duration of paper will be 3 hours.
- **Project Report / Dissertation**
  The project / Dissertation will be evaluated by the internal panel approved by Principal cum Director of the college and external examiner from the panel approved by the university authority/evaluation branch, HPTU, Hamirpur. The Head of the Department will assign a guide/supervisor, to each candidate for his/her project /Dissertation work. The candidate shall be required to maintain his/her project diary (logbook) of work in the organization or under the Guide. Each student will be required to give at least two seminars on his/her project work/ Dissertation work. Each student is required to submit three copies of his/her project reports in the Department after completion of the project work which will be evaluated by external examiner. Most of the students are expected to work on a real-life project / Research preferably in some industry/ Research and Development Laboratories/Educational Institution/Software Company. The student can formulate a project problem / Research problem with the help of her/his Guide and submit the project proposal / Research proposal of the same in the college within 10 days at the starting of Major Project. Approval of the project proposal is mandatory which will be evaluated by internal examiner appointed by respective college Principal or Director or university. If approved, the student can commence working on it and complete it by using the latest versions of the software packages / Research Tools for the development of the project / Dissertation. The format for synopsis to be submitted in the third semester and the final thesis dissertation format is attached in Annexure-I and Annexure-II.

- **Instructions for paper setter**
  In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt at least one question from each unit. Question number nine will be compulsory, which will be of short answer type questions with 6 to 8 parts, covering entire syllabus. In all, five questions are to be attempted. The question paper for the end semester examination may have any one of the following patterns:
  Section A (UNIT I) Two questions of long answer type of which one is to be attempted for 12 Marks.
  Section B (UNIT II) Two questions of long answer type of which one is to be attempted for 12 Marks.
  Section C(UNIT III) Two questions of long answer type of which one is to be attempted for 12 Marks.
  Section D(UNIT IV) Two questions of long answer type of which one is to be attempted for 12 Marks.
  Section E(Compulsory) 6 to 8 short answer type questions for 2 to 1.5 marks each and total for 12 Marks.
  Total marks (A + B + C + D+ E) 12+ 12 + 12 +12+12 = 60 marks

End Semester Examination (ESE)

For theory course, the question paper for the final examination will consist of five sections-A, B, C, D & E. Sections A, B, C, D will have two questions each from the corresponding units I, II, III & IV of the syllabus. Section E will be compulsory and will have short answer type questions covering the whole syllabus. Each question will be of 12 or 8,4 or 6,6 marks. The candidates will attempt five questions in all, i.e.one question each from the sections A, B, C, D, and the compulsory question from section E. The question paper is expected to contain problems with a minimum weightage of 25% of the total marks from each unit.

Template for End Semester Examination (4,3,2 credits)

Roll No:……. **Total**

Pages…..……

Month-Year (June-2023)

M.Tech Examination

Paper Code

Subject Title

Semester-X (NEP-2020)

Time: 3 Hours **Max. Marks: 60**

The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt five questions in all by selecting one question from each section A, B, C and D. Section-E is compulsory.

SECTION – A

(1x12 or 8,4 or 6,6)

1.

2.

SECTION – B

(1x12 or 8,4 or 6,6)

3.

4.

SECTION – C

(1x12 or 8,4 or 6,6)

5.

6.

SECTION – D

(1x12 or 8,4 or 6,6)

7.

8.

SECTION – E (Compulsory)

(6×2=12)

9.

(a-f)

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Periodical Examination (PE)

During one semester, there will be two periodical examinations for theory and practical subjects. The question paper will consist of three sections A, B and C having total 20 marks. Section A will be compulsory *and will have short answer type questions consisting of five parts, each of one mark covering the syllabus mentioned.* Sections B and C will contain descriptive type questions of five and ten marks respectively. *Sections B and C will have two questions and the candidates will attempt three questions in all, i.e. one question each from the sections B and C.* Section-A is compulsory.

Template for Periodical Examination (4,3,2 credits)

Roll No:……. **Total**

Pages…..……

Month-Year (June-2023)

M.Tech Examination

Paper Code

Subject Title

Semester-X (NEP-2020)

Time: 1.5 Hours **Max. Marks: 20**

Note: Attempt three questions in all by selecting only one question from each section B and C. Section-A is compulsory.

SECTION – A (Compulsory)

(8x1=8)

1. (a-h)

SECTION – B

(6)

2.

3.

SECTION – C

(6)

4.

5.

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6. Purposed Subject Code System

Each subject code is denoted by alpha-numerals, alphabets before hyphen indicates course name and four numerals after hyphen indicates level, semester, and subject number respectively.

- For Example: CSE-6201
- First three alphabets "CSE" is degree indicator.
- First number "6" defines the Level 6 for level 6 subjects.
- Second number "2" defines the semester.
- Third and fourth number are for subject number.

7. Assessment & Evaluation

- **IA-Internal Assessment (Theory)**

  Periodical Examination (PE) -I and Periodical Examination (PE) -II = Weightage of **20** Marks (Average of PE-I and PE-II)

  Teacher's Assessment (Assignment discussion/ presentation/Quizzes/Overall behaviour)= 15 Marks

  Attendance = 05 Marks

Sr. No.	Percentage of Lecture Attended	Marks Awarded
1	From 75% to 80%	01
2	Above 80% to 85%	02
3	Above 85% to 90%	03
4	Above 90% to 95%	04
5	Above 95%	05

- **IA-Internal Assessment (Practical)**
  Periodical Examination (PE) (Written/Presentation & Viva-Voce) = **20**
  Teacher's Assessment (Lab /Work Performance/Report/File Work) = **15**
  Attendance = **05**

- **EA-External Assessment (Theory)**
  ESE-End-Semester Examination = 60 for all courses.

Total marks for theory evaluation = (20 + 15 + 05 + 60 =100) for all courses.

- **External Assessment (Practical)**

  ESE-End-Semester Examination (written script, performance, External viva-voce etc.) = **60**

Total marks for practical evaluation = 20+20+60 =100

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Template for- IA-Internal Assessment (Theory)

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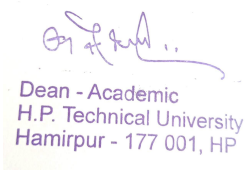
AWARD SHEET THEORY (INTERNAL ASSESSMENT)

<table>
<tr><td colspan="3">Name of the Institution:</td><td colspan="4">Distribution of Marks</td><td rowspan="3">Total Marks</td></tr>
<tr><td colspan="3">Programme:</td><td colspan="2" rowspan="2">Periodical Examinations</td><td rowspan="3">Teacher Assessment Assignment discussion/ presentation/Quizzes/Overall behaviour</td><td rowspan="3">Attendance</td></tr>
<tr><td colspan="3">Subject: Sub. Code:</td></tr>
<tr><td colspan="3">Branch: Semester:</td><td>1st Periodical Examination</td><td>2nd Periodical Examination</td><td></td></tr>
<tr><td colspan="3">MAX. MARKS: MIN. MARKS:</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sr. No.</td><td>University Roll No.</td><td>Name of Student</td><td>10</td><td>10</td><td>15</td><td>05</td><td>40</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Name of Internal Examiner — Signature…… Date……..

Head of Dept — Signature…….. Date……..

Head of the Institution — Signature…… Date……



Template for-IA-Internal Assessment (Practical/Project/Seminar/Viva-Voce)

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AWARD SHEET PRACTICAL (INTERNAL ASSESSMENT)

(Practical/Project/Seminar/Viva-Voce)

<table>
<tr><td colspan="3">Name of the Institution:</td><td colspan="4">Distribution of Marks</td><td rowspan="4">Total Marks</td></tr>
<tr><td colspan="3">Programme:</td><td colspan="2" rowspan="2">Periodical Examination</td><td rowspan="3">Teacher Assessment
Lab work performance/Report/File work</td><td rowspan="3">Attendance</td></tr>
<tr><td colspan="3">Subject: Sub. Code:</td></tr>
<tr><td colspan="3">Branch: Semester:</td><td>Written/Presentation</td><td>Viva-voce</td></tr>
<tr><td colspan="3">MAX. MARKS: MIN. MARKS:</td><td>10</td><td>10</td><td>15</td><td>05</td><td>40</td></tr>
<tr><td>Sr. No.</td><td>University Roll No.</td><td>Name of Student</td><td colspan="5"></td></tr>
<tr><td></td><td></td><td></td><td colspan="5"></td></tr>
<tr><td></td><td></td><td></td><td colspan="5"></td></tr>
<tr><td colspan="8">Name of Internal Examiner
Signature……
Date…… Head of Dept
Signature……
Date…… Head of the Institution
Signature……
Date……</td></tr>
</table>

Note: The distribution of marks for Institutional training, Internship, Survey, SWAYAM, MOOCs, NPTEL courses (if any) would be same as above.

Template for-External Examination

(Practical/Project/Seminar/Viva-Voce)

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Department of Engineering & Technology, School of Computer Science & Engineering

(Practical/Project/Seminar/Viva-Voce)

Name of the Institute: …….

Programme: ……

Subject Name:…….. …… Subject Code:…….

Branch: …….. Semester ……

Max Marks …… Min. Marks:……

Sr. No.	University Roll No.	Name of Student	Marks in Figure	Marks in Words

Name of Internal Examiner: …….. External Examiner……..

Signature…….. Signature……..

Date…….. Date……..

Note: The distribution of marks would be on the basis of Work done/Task performance (20 marks), Performance (written/presentation) (20 marks) and viva-voce (20 marks), total=60 marks.

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8. Overall General Instructions:

Each paper will be of 100 marks (60 marks for external and 40 marks for internal) and the duration of paper will be 3 hours. The candidate shall be declared to have passed the examination if the candidate secures not less than 24 marks in the End Semester Examinations of each paper and secures not less than 16 marks in the Internal Assessment (IA) and overall aggregated marks is 40 in both the external and internal taken together.

- Each theory lecture per hour will be considered as one credit and two practical hours as one credit. For each theory course of 04 credits, there will be 4 lecture hours of teaching per week and for each theory course of 02 credits, there will be 2 lecture hours of teaching per week. For each practical course of 02 credits, there will be 04 lecture hours of teaching per week and for practical course of 04 credits, there will be 08 lecture hours of teaching per week. For the other course categories, the lecture hours per credit would be same as those of having theory subjects.
- In each semester, the students are required to perform at least ten experiments out of the listed experiments.
- For Seminar, Industrial Training, Research Project, Summer Internship, Survey, SWAYAM, MOOC, NPTEL; the internal and external assessment shall be same as that of theory/practical courses i.e., 100 (60 % ESE & 40 % IA) marks.
- The distribution of internal & external assessment for Project work, Seminar and other course categories will be same as that of Core Compulsory course/Discipline Specific Courses and also as per the format mentioned above. (Read all the instructions mentioned in each course content semester-wise)
- Teaching hours per semester for each 04-credit theory course will be minimum 60 hours and of 02 credit theory course will be minimum 30 hours.
- For Research project, Seminar/SWAYAM/MOOC/NPTEL/Industrial Internship/Survey, the time frame for the duration of classes, examination, format for writing the report and evaluation system will be as per the format given as well as may be decided by the Department/University itself or organizing/host/collaborative institutions time to time after the approval from BoS.
- On the basis of the interest/availability of the students from other departments, any other relevant course for the Inter-departmental Courses (ID) may be offered at the spot after the approval from Authority/Department.
- Students having the attendance below 75% in each course will not be allowed to appear in the final examination. The students having attendance lying between 70-75% may be allowed to submit the examination form and finally to appear in the examinations only after the approval from the Dean/concerned authority. Similarly, the students having attendance lying between 65-70% may be allowed to submit the examination form and finally to appear in the examinations only after the approval from the Vice-Chancellor only on the request basis.
- For Theory examinations (Internals), two examinations; Periodical Examination-I and Periodical Examination-II will be conducted and for the practicals and other course categories, only one periodical examination will be conducted-as the internal examination along with other parameters as mentioned in the instructions (mentioned above).
- Both the periodical examinations are mandatory. If, in any case, the student is not able to appear in any of

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the above examinations, then the option of Make-up Examination will be given to the student. For that, he/she has to report before that examination to the concerned teacher/head of the department. Within 3 days, he/she has to submit the documents related to the cause and finally get permission from the concerned Authority. After getting the permission, the student has to appear in the examination within 10 days with the weightage of 80% only. For example, if the student scoring 15 marks with the weightage of 100%, then he/she will be given 12 marks (80% weightage).

- Duration: One year divided into two semesters. Total duration is of 02 years (04 semesters)
- Medium of instruction: English and Passing Standard: As mentioned in the Ordinance.
- In regard to maintain the record of the answer-sheets, after the completion of one year, all the used answer-sheets of internal examinations, project reports, practical note-books etc. would be allowed to disposed off.

SUBJECT COMBINATIONS ALLOWED FOR M.TECH CSE PROGRAM

THE DETAILS OF CREDIT DISTRIBUTION

School: School of Computer Science & Engineering

Program: Master of Technology (M.Tech CSE)

Core Courses (CC) (Theory & Practicals)			**Discipline Specific Elective Courses** (DS)			**Value Added, Skill Enhancement Elective Courses and Minor Elective Courses** Seminar/Industrial Training/Summer Internship/Survey/SWAYAM/MOOC/NPTEL			**Inter Departmental (ID)**			**Dissertation Minor/Major**		
10 Papers (Theory) of 04 credits each			**03 Papers (Theory) of 04 credits each**			**01 Papers of 03 credits**								
Sem.	Papers	Credit	Sem.	Papers	Credit	Sem.	Papers	Credit	Sem.	Papers	Credit	Sem.	Papers	Credit
I	05	20	I	-	-	I	01	02	I	-	-	I	-	-
II	03	12	II	02	08	II	01	02	II	-	-	II	-	-
III	01	04	III	01	04	III	01	03	III	-	-	III	01	09
IV	-	-	IV	-	-	IV	-	-	IV	-	-	IV	01	16
03 Practical Labs														
Sem.	Papers	Credit												
I	02	02												
II	02	02												
III	-	-												
IV	-	-												
Credits = 40			**Credits = 12**			**Credits = 07**			**Credits = 00**			**Credits = 25**		
Total Credits = 84						**Total Marks = 2200**								

Note: *For getting the degree to be awarded, the student has to pass all* ***84 credits*** *out of* ***84 credits (2200 marks)***

Scheme of Teaching and Examination
Master of Technology(M.Tech)

Semester-I

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
							ESE	Internal Assessment				
			L	T	P			PE	TA	A	Total	
CSE-6101	CC	Computer Networks	3	1	0	4	60	20	15	05	40	100
CSE-6102	CC	Advanced Computer Architecture	3	1	0	4	60	20	15	05	40	100
CSE-6103	CC	Software Engineering and Project Planning	3	1	0	4	60	20	15	05	40	100
CSE-6104	CC	Advanced DBMS	3	1	0	4	60	20	15	05	40	100
CSE-6105	CC	Advanced Operating System	3	1	0	4	60	20	15	05	40	100
UHV-6100	VAC	Universal Human Values and Professional Ethics	02	0	0	02	60	20	15	05	40	100
Lab Courses												
CSE-6106P	CC-LAB	Advanced DBMS Lab	0	0	2	1	60	20	15	05	40	100
CSE-6107P	CC-LAB	Advanced Operating System Lab	0	0	2	1	60	20	15	05	40	100
Total			**17**	**05**	**04**	**24**	**480**	**160**	**120**	**40**	**320**	**800**

Legends:	**CC -** Core Course	**TA -** Teacher's Assessment
	SEC - Skill Enhancement Course	**A –** Attendance
	DSE - Discipline Specific Electives	**L –** Lecture
	VAC- Value Addition Course	**T –** Tutorial
	PE – Periodical Examination	**P** – Practical
	ESE-End Semester Examination	

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Scheme of Teaching and Examination
Master of Technology(M.Tech)

Semester-II

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE	TA	A	Total	
CSE-6201	CC	Artificial Intelligence & Machine Learning	3	1	0	4	60	20	15	05	40	100
CSE-6202	CC	Wireless Sensor Network	3	1	0	4	60	20	15	05	40	100
CSE-6203	CC	Programming Paradigms	3	1	0	4	60	20	15	05	40	100
CSE-6211	DSE	Departmental Elective-I	3	1	0	4	60	20	15	05	40	100
CSE-6212	DSE	Departmental Elective-II	3	1	0	4	60	20	15	05	40	100
IKS-6200	VAC	Indian Knowledge System	2	0	0	2	60	20	15	05	40	100
CSE ID-6201	ID	Inter Departmental Elective	2	0	0	2	60	20	15	05	40	100
Lab Courses												
CSE-6206P	CC-LAB	Programming Lab	0	0	2	1	60	20	15	05	40	100
CSE-6207P	CC-LAB	AI& ML Lab	0	0	2	1	60	20	15	05	40	100
Total			**19**	**05**	**04**	**26**	**540**	**180**	**135**	**45**	**360**	**900**

Legends:	**CC -** Core Course	**TA -** Teacher's Assessment
	SEC - Skill Enhancement Course	**A –** Attendance
	DSE - Discipline Specific Electives	**L –** Lecture
	ESE-End Semester Examination	**T –** Tutorial
	PE – Periodical Examination	**P** – Practical
	VAC- Value Addition Course	

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Scheme of Teaching and Examination
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Semester-III

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE	TA	A	Total	
CSE-7301	CC	Research Methodology	3	0	0	3	60	20	15	05	40	100
CSE-7311	DSE	Programme Elective-III	3	1	0	4	60	20	15	05	40	100
CSE-7303	VAC	Seminar	--	3	--	3	60	20	15	05	40	100
CSE-7304	CC	Dissertation-I	--	--	9	9	60	20	15	05	40	100
Lab Courses												
CSE-7306P	CC-LAB	Research Methodology	0	0	2	1	60	20	15	05	40	100
Total			**6**	**04**	**11**	**20**	**300**	**100**	**75**	**25**	**200**	**500**

Legends:	**CC -** Core Course	**TA -** Teacher's Assessment
	SEC - Skill Enhancement Course	**A –** Attendance
	DSE - Discipline Specific Electives	**L –** Lecture
	ESE-End Semester Examination	**T –** Tutorial
	PE – Periodical Examination	**P** – Practical
	VAC – Value Addition Course	

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Semester-IV

Subject Code	Course Category	Subject Title/ Subject Name	Credits	Evaluation Scheme	Total
CSE-7401	CC	Dissertation-II	16	As per M.Tech ordinances	200

Legends:	**CC -** Core Course

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List of Discipline Specific Electives-I

S.No.	Course Category	Subject Code	Subject Title/ Subject Name
1.	DSE	CSE-6211(i)	Probability & Statistics with Queuing Theory
2.	DSE	CSE-6211(ii)	Data Mining
3.	DSE	CSE-6211(iii)	Cloud Computing
4.	DSE	CSE-6211(iv)	Natural Language Processing

List of Discipline Specific Electives-II

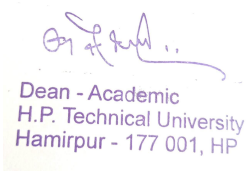
S.No.	Course Category	Subject Code	Subject Title/ Subject Name
1.	DSE	CSE-6212(i)	Distributed Database Management System
2.	DSE	CSE-6212(ii)	Formal Languages and Automata Theory
3.	DSE	CSE-6212(iii)	Data Analytics
4.	DSE	CSE-6212(iv)	Soft Computing

List of Inter Departmental Electives

S.No.	Course Category	Subject Code	Subject Title/ Subject Name
1.	ID	CSE ID-6201(i)	Mobile Computing
2.	ID	CSE ID-6201(ii)	Data Storage Technologies and Networks
3.	ID	CSE ID-6201(iii)	Object Oriented Techniques
4.	ID	CSE ID-6201(iv)	Steganography and Digital Watermarking

List of Discipline Specific Electives-III

S.No.	Course Category	Subject Code	Subject Title/ Subject Name
1.	DSE	CSE-7311(i)	Cryptography and Network Security
2.	DSE	CSE-7311(ii)	Cyber Security
3.	DSE	CSE-7311(iii)	Cyber Forensics
4.	DSE	CSE-7311(iv)	Data Security and Access Control



HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus

for

M.Tech CSE

(SEMESTER-I)

Amended as per NEP-2020

(w.e.f. the Academic Year 2023-2024)

Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

CSE-6101 Computer Networks							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To introduce the concept, terminologies, and technologies used in modern data communication and computer networking.
- To identify importance of OSI and TCP/IP models.
- To make students to get familiarized with different protocols and network components.
- Able to analyze the concept of local area networks, their topologies, protocols and applications.
- Be able to evaluate the performance of competing network technologies and protocols

Unit I	**15 Lectures**
Data Communication: Network Components, Protocol & Standards, Standard Organization, Topologies, Transmission modes, Categories of Networks, Uses, Applications. **The OSI Reference Model:** Layered architecture, Functions of layers. **TCP/IP reference model**: Comparison of OSI & TCP/IP models. Internet, ATM, Ethernet, Wireless LAN. **Physical layer:** Theoretical basis for data communications: bandwidth limited signals, Guided and wireless transmission media, Communication satellites, Public switched telephone networks, mobile telephone system, Cable television.	
Unit II	**15 Lectures**
Data Link and Mac Layer: Design issues, Framing techniques, Flow control, Error Control, Error Detecting code and Error Correcting codes, Data link Control and Protocols-- For noiseless Channel – Simplest Protocol, Stop-and Wait Protocol, For Noisy Channel-- Stop-and-Wait ARQ, Go-Back-N ARQ, and Selective-Repeat ARQ Protocol, HDLC Protocol, and PPP Protocol, Multiple Access-- Random Access-- MA, CSMA, Controlled Access, Channelization and IEEE standards.	
Unit III	**15 Lectures**
Network Layer: Network layer design issues, Addressing, Routing algorithms-shortest path routing, flooding, distance vector routing, link state routing, hierarchical routing, broadcast routing, multicast routing, Congestion Control algorithms, definition of quality of service, Internetworking, Network layer in Internet –IP protocol, IP Address, OSPF, BGP, Internet multicasting, Mobile IP. **Transport Layer:** Concept of transport service, elements of transport protocols, A simple transport protocol, Remote procedure call, Performance issues incomputer networks.	

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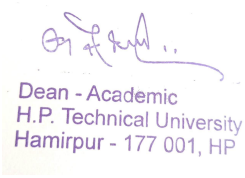
Unit IV	15 Lectures
Session Layer : Design issues, Functions, Session layer Protocols: RTCP, PPTP, PAP, ADSP **Application layer**: services protocols & Network Security: DNS, SMTP, FTP, TELNET, HTTP, WWW. **5G Use Cases and System Concept:** Use cases and requirements, 5G system concept.	

Course Learning Outcomes (CLOs)

- Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.
- Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure.
- Specify and identify deficiencies in existing protocols and then go onto formulate new and better protocols.

Suggested Readings:

- B.A. Forouzan, "Data Communication & Networking", 4th Edition Tata Mcgraw Hill.
- A.S. Tanenbaum, "Computer Networks", Prentice Hall, 1992, 4th edition.
- William Stallings, "Data & Computer Communication", McMillan Publishing Co. Black, "Data Networks", PHI, 1988.
- Fred Halsall, "Data Communications, Computer Networks", Pearson Education.



CSE-6102 Advanced Computer Architecture							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To understand the advance hardware and software issues of computer architecture
- To understand the multi-processor architecture & connection mechanism
- To understand multi-processor memory management

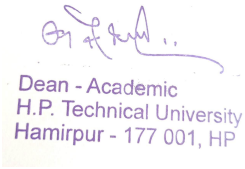
Unit I	**15 Lectures**
Parallel Computer Models & Program Parallelism: Parallel Processing and its Applications, Flynn's Classification: SISD, SIMD&MIMD, its Architecture, Condition of Parallelism, Data and Resource Dependences, Conditions of Parallelism, Hardware and Software Parallelism, Program Partitioning & Scheduling ,**Program Flow Mechanisms:** Control Flow versus Data Control, Data Flow Architecture, Demand-Driven Mechanisms. Vector Instruction Types, Vector Access Memory Schemes, Vector and Symbolic Processors.	
Unit II	**18 Lectures**
Scalability and Performance evaluation: Principles of Scalable Performance, Performance Metrics And Measures, Speedup Performance Laws: Amdahl's Law, Gustafson's Law, Scalability Analysis and Approaches, CPU Performance Evaluation. **Pipeline:** Linear and Nonlinear Pipeline Processor, Pipeline Performance, Instruction Pipeline Design, Instruction Pipeline, Mechanisms for Instruction Pipeline, Dynamic Instruction Scheduling, Branch Handling Techniques, Arithmetic Pipeline Design, Computer Arithmetic Principles.	
Unit III	**15 Lectures**
Memory Hierarchy & Organization: Cache Memories, Cache Coherence and its Issues, Cache Addressing Models, Direct Mapping and Associative Caches, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Hierarchical Memory Technology, Memory Capacity Planning, Virtual Memory Technology.	
Unit IV	**12 Lectures**
System Interconnection: Multiprocessor System Interconnection and Multi Computers, Network Properties and Routing, Hierarchical Bus Systems, Static Interconnection Networks, Dynamic Interconnection Networks.	

Course Learning Outcomes (CLOs)

- Interpret the performance of a processor based on metrics such as execution time, cycles per instruction (CPI), Instruction count etc
- Predict the challenges of realizing different kinds of parallelism (such as instruction, data, thread, core level) and leverage them for performance advancement
- Apply the concept of memory hierarchy for efficient memory design and virtual memory to overcome the memory wall

Suggested Readings:

- Kai Hwang, "Advanced computer architecture", 2nd Edition, Tata McGraw Hill, 2010
- Morris Manno, "Computer System Architecture", Revised 3rd Edition, Pearson Publications, 2017
- J. P. Hayes, "Computer Architecture and Organization", 3rd Edition, Tata McGraw Hills, 2017
- D. A. Patterson, J. L. Hennessy, "Computer Architecture: A quantitative approach", Morgan Kauffmann Publishers, 2011.
- Hwang and Briggs, "Computer Architecture and Parallel Processing", Mc Graw Hills.
- R. W. Hockney, C. R. Jesshope, "Parallel Computer 2", 2nd Edition, Adam Hilger.



CSE-6103 Software Engineering and Project Planning							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioral models.
- Understanding of different software architectural styles.
- Understanding of approaches to verification and validation including static analysis, and reviews.
- Understanding on quality control and how to ensure good quality software.

Unit I	**15 Lectures**
Project Planning: Characteristics of a software project, Software scope and feasibility, resources, the SPM plan. Software Process Models. **Software Project Estimation:** Size/scope estimation, Decomposition techniques, WBS. Effort estimation: Sizing, Function point, LOC, FP vs LOC. Schedule estimation: GANTT Charts, Activity networks, Cost estimation: Models: COCOMO I, COCOMO II.	
Unit II	**15 Lectures**
Quality Planning: Quality control, Quality assurance, Formal Technical Reviews, The SQA Plan, ISO and CMM standards. **Risk Management:** Reactive vs proactive Risk strategies, Risk projection, Risk Refinement, Risk Monitoring, Monitoring and management, RMMM plan.	
Unit III	**15 Lectures**
Measurement and Tracking Planning: Earned Value Analysis. **Team Management**: Team structures: hierarchical, Egoless, chief programmer, mixed; Team software Process; Resource leveling, Building a team: Skill sets.	
Unit IV	**15 Lectures**
Configuration Management: Baselines, Configurable items, SCM repository, SCM process, version control change control, configuration audit. **Project Monitoring and Control:** Audits and Reviews.	

Course Learning Outcomes (CLOs)

- Basic knowledge and understanding of the analysis and design of complex systems.
- Ability to apply software engineering principles and techniques.
- Ability to develop, maintain and evaluate large-scale software systems.
- Ability to perform independent research and analysis.
- To manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain.
- Ability to understand and meet ethical standards and legal responsibilities.

Suggested Readings:

- Software Project Management, Bob Hughes and Mike Cotterill, Tata McGraw Hill 5th edition, 2009
- A practitioner's Guide to Software Engineering, Roger Pressman, Tata McGraw Hill 2014 8th edition
- Headfirst PMP: A Brain Friendly Guide To Passing The Project Management Professional Exam,2013

CSE-6104 Advanced DBMS							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- The main objective of this course is to enable students to the fundamental concepts of databases and distributed database.
- To recognize the importance of database analysis and design in the implementation of any Database application and to understand the process normalization.
- 3.It also gives the knowledge of the roles of transaction processing and concurrency control both in DBMS and distributed environment.

Unit I	**15 Lectures**
Database Management System: Introduction, Types of Data Models, Schema, relationships, Keys Concept, RDBMS. Normalization: Functional Dependencies, various normal forms.	
Unit II	**15 Lectures**
Introduction to Object Database Systems: Introduction, Structured Data types, operations on structured data, Encapsulation and ADTS, Inheritance Objects, IDs, and reference types, implementation of various complex types in SQL. ORDBMS: Design, implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS.	
Unit III	**15 Lectures**
Transaction Management: Transactions basic concepts, and Schedules, Serializability Concept, Concurrency Control Mechanisms- Locking protocols, Timestamp based, and optimistic approaches. Deadlocks Management in DBMS- prevention, handling and avoidance.	
Unit IV	**15 Lectures**
Distributed databases: Introduction, Distributed DBMS architectures, Need of distributed databases, Types of Fragmentation, Distributed query processing, Distributed concurrency control, Distributed Recovery. RAID.	

Course Learning Outcomes (CLOs)

- Apply normalization techniques.
- Understand how transactions are processed in a database.
- Discuss/explain the concepts of Distributed Databases and Data Warehousing.
- Discuss/explain some database security issues.

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Suggested Readings:

- Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
- Data base System Concepts, A. Silber Schatz, H.F. Korth, S. Sudarshan, McGraw hill, VI edition, 2006.
- Fundamentals of Database Systems 5th edition. Ramez Elma Sri, Shamkant B. Navathe, Pearson Education, 2008.
- Introduction to Database Systems, C.J. Date, Pearson Education.
- Principles of Distributed Database Systems, by M tamer Ozsu, Patrick Valduriez, Third Edition, Springer.

CSE-6105 Advanced Operating System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

The main objective of this course is to provide conceptual as well as practical knowledge about Operating system (Windows and Linux).

Unit I	**15 Lectures**
Introduction: Definition, Functions of an OS, Evolution. Types of advance operating systems, **Process Management**: Process- Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Threads, Inter-Process Communication, **CPU Scheduling**–various algorithms.	
Unit II	**15 Lectures**
Process Synchronization, **Deadlock Management**: detection, prevention and handling. **Memory Management**: Logical & physical address space, Swapping, Continuous Allocation, fragmentation, paging, segmentation, Page Replacement, Page Replacement Algorithms, counting algorithms Thrashing.	
Unit III	**15 Lectures**
File System Interface: File Concept, Access Methods, File System Implementation, Free Space Management, **Directory Implementation**–linear list, hash table, Efficiency and Performance, Recovery – consistency checking, backup and restore. **Secondary Storage Structure**: Disk Structure, Disk Scheduling Algorithms.	
Unit IV	**15 Lectures**
Distributed Systems: Introduction, Design issues, Communication in distributed Systems. **Synchronization in Distributed Systems:** Clocks synchronization, Mutual Exclusion, Election Algorithms. **Memory and Deadlock Management in distributed Systems.** **Case Study:** UNIX system, **Case Study:** MS-DOS.	

Course Learning Outcomes (CLOs)

- Understands the different services provided by Operating System at different level.
- They learn real life applications of Operating System in every field.
- Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock. They will learn different memory management techniques like paging, segmentation and demand paging etc.

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Suggested Readings:

- Software Project Management, Bob Hughes and Mike Cotterill, Tata McGraw Hill 5th edition, 2009
- A practitioner's Guide to Software Engineering, Roger Pressman, Tata McGraw Hill 2014 8th edition
- Head First PMP: A Brain Friendly Guide To Passing The Project Management Professional Exam,2013

UHV-6100 Universal Human Values and Professional Ethics							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**	**C**	**Internal Assessment**	**End Semester Examination**	**Total**	
2	**0**	**0**	**2**	**Maximum Marks: 40**	**Maximum Marks: 60**	**100**	**3 Hours**
				Minimum Marks: 16	**Minimum Marks: 24**	**40**	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
- To enable the students to imbibe, internalize the values and ethical behavior in the personal and Professional lives.

Unit I	**8 Lectures**
Right understanding, Relationship and physical facility (holistic development and the role of education), Understanding value education, Self-exploration as the process for value education, Continuous happiness, and prosperity-the basic human aspirations exploring human consciousness, Happiness and prosperity-current scenario, Method to fulfil the basic human aspirations, Exploring natural acceptance	
Unit II	**8 Lectures**
Understanding human being as the co-existence of the Self and the Body, distinguishing between the needs of the Self and the Body, Exploring the difference of needs of Self and Body, The Body as an instrument of the self-understanding, Harmony in the self-program to ensure Self-regulation and Health exploring harmony of Self with the Body.	
Unit III	**8 Lectures**
Harmony in the family-the basic unit of human interaction, 'Trust'–the foundational value in relationship, Exploring the feeling of trust, 'Respect'–as the right evaluation, Exploring the feeling of respect and other feelings, Justice in human-to-human relationship, understanding harmony in the society, Vision for the universal human order, exploring systems to fulfil human goal.	
Unit IV	**6 Lectures**
Ethics -definitional aspects, Nature of ethics, Scope of ethics, The philosophical basis of ethics, Family ethics, Ethics at the workplace and professions, Relevance of ethics in society.	

Course Learning Outcomes (CLOs)

- Students will be able to understand the harmony in nature and existence and work out their mutually fulfilling participation in nature.
- Students will be able to relate ethical concepts and materials to ethical problems in specific professions and professionalism.
- Students will be made available to be aware about the types of ethical challenges.

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Suggested Readings:

- R R Gaur, R Asthana, G P Bagaria, The Textbook A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
- R R Gaur, R Asthana, G P Bagaria, The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
- R. R. Gaur, R. Sangal, G. P. Bhagaria, A Foundation Course in Value Education, Excel Books Publisher.
- Ek Parichaya, A Nagaraj, Amar Kantak, Jeevan Vidya, Jeevan Vidya Prakashan, 1999.
- A.N. Tripathy, 2003, Human Values, A Foundation Course in Human Values and Professional Ethics, New Age International Publishers.
- Mohandas Karamchand Gandhi, The Story of My Experiments with Truth**.**

CSE-6106P Advanced DBMS Lab							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**	**C**	**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**2**	**1**	**Maximum Marks: 40**	**Maximum Marks: 60**	**100**	**3 Hours**
				Minimum Marks: 16	**Minimum Marks: 24**	**40**	

Sr. No.	**List of Experiments**
	Exercises based on
1.	Data Definition Language Commands
2.	Data Manipulation Language Commands
3.	Data Control Language, Transfer Control Language Commands
4.	In Built Functions
5.	Nested Queries and Join Queries
6.	Set operators
7.	Views
8.	Control Structure
9.	Procedure and Function
10.	Trigger

Note: 8-10 experiments are to be performed based on the topics listed above.

CSE-6107P Advanced Operating System Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Sr. No.	Name of Experiment
1.	Study and explain the types of operating systems (their types with structure, functionality, dependencies, application software with their differences).
2.	Installation of any one of the operating system (UBUNTU, CENT-OS).
3.	Write a C-program to present the Output of different file operation.
4.	Write a C-program to implement any file allocation technique (Linked, Indexed or Contiguous)
5.	Write a C-program to Present the Output of following CPU Scheduling algorithm.
6.	Write a C-program to Present the Output of following Page Replacement Algorithm.
7.	Write a C-program to implement memory management algorithm for memory management.
8.	Write a C-program to present the Output for Producer– Consumer problem concept.
9.	Simulate Bankers algorithm for Deadlock Avoidance
10.	Write a C-program to implement Disk scheduling algorithms.

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HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus

for

M.Tech CSE

(SEMESTER-II)

Amended as per NEP-2020

(w.e.f. the Academic Year 2023-2024)

Dean - Academic
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CSE-6201 Artificial Intelligence & Machine Learning							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

The main objective of this course is to provide conceptual as well as practical knowledge of Artificial Intelligence and related technologies. After completing the course the student should be competent in Prolog Programming tools and also able to understand the Artificial Intelligence and its applications for real life problems.

Unit I	**15 Lectures**
Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation of Problems, Heuristic Search Techniques, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.	
Unit II	**15 Lectures**
Knowledge Representation and Reasoning: Representation and Reasoning using predicate logic, Inference in first order logic, forward and backward chaining. Probabilistic reasoning, Bayesian networks, Dempster Shafer theory, Probabilistic Reasoning over time: Hidden Markov Models, Kalman Filters.	
Unit III	**15 Lectures**
Uninformed search and Informed search based on heuristics, Local search algorithms and optimization problems, **Adversarial search:** Games, Optimal decisions in games, Alpha-beta pruning, Online search. Learning from examples, Forms of Learning, Inductive Learning, Learning decision trees, learning in problem solving, Learning Probabilistic models, Bayesian learning, Learning in neural and belief networks. Learning with hidden variable.	
Unit IV	**15 Lectures**
AI Applications: Expert system, decision support systems, speech and vision, natural language processing, semantic web, robotics, Al-based programming Tools.	

Course Learning Outcomes (CLOs)

- Understand the concepts of Artificial Intelligence and intelligent agents.
- Understand and learn knowledge representation and reasoning for the problem-solving solving.
- Apply basic search techniques for problem-solving**.**
- Understand and apply learning techniques.
- Apply and utilize AI knowledge for application in the real world.

Suggested Readings:

- Artificial Intelligence: A Modern Approach, S Russel and P Norvig, 3rd Edition, 2015 Prentice Hall.
- Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson, Pearson Education.
- Artificial Intelligence and Expert Systems — Patterson PHI.

CSE-6202 Wireless Sensor Network							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To understand the basics of Sensor Networks.
- To learn various fundamental and emerging protocols of all layers.
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad- hoc and sensor networks.
- To understand various security practices and protocols of Sensor Networks.

Unit I	**15 Lectures**
Introduction and overview of Wireless Sensor Networks (WSN), Commercial and Scientific Applications of WSN, Category of Applications of WSN, Challenges for WSN, Enabling Technologies for WSN. **Single node Architecture:** Hardware Components, Energy Consumption of Sensor nodes, Operating Systems and Execution Environments, Examples of Sensor Nodes, **Network Architecture:** WSN Scenarios, Optimization Goals and figures of Merits, Design principles for WSNs, Service Interfaces for WSNs, Gateway Concepts.	
Unit II	**15 Lectures**
Physical Layer: Wireless Channel and Communication Fundamentals, Physical Layer & Transceiver Design Considerations in WSN. **MAC Protocols:** Fundamentals, MAC Protocols for WSNs, IEEE802.15.4 MAC Protocol, Routing Protocols: Gossip and agent based unicast protocols, Energy Efficient Unicast, Broadcast and Multicast, Geographic Routing, Transport Control Protocols: Traditional Protocols, Design Issues, Examples of Transport Protocols, Performance of Transport Control Protocols.	
Unit III	**15 Lectures**
Sensor Tasking and Control: Information-Based Sensor Tasking, Joint Routing Information Aggregation, Sensor Network Databases: Challenges, Query Interfaces, In-Network Aggregation, Data Centric Storage, Data Indices and Range queries, Distributed Hierarchical Aggregation, Temporal Data.	
Unit IV	**15 Lectures**
Operating Systems for Sensor Networks: Introduction, Design Issues, Examples of Operating Systems, Node Level Simulators, Performance and Traffic Management Issues: WSN Design Issues, Performance Modelling of WSNs, Emerging Applications and Future Research Directions. **Mobility and Handoff Management in 5G :** Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.	

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Course Learning Outcomes (CLOs)

Upon successful completion of the course, the student will be able to

- Describe the overview of wireless sensor networks and enabling technologies for wireless sensor networks.
- Apply the design principles of WSN architectures and operating systems for simulating environment situations.
- Apply various concepts for assignment of MAC addresses.
- Select the appropriate infrastructure, topology, joint routing and information aggregation for wireless sensor networks.
- Analyse the sensor network platform and tools state-centric programming

Suggested Readings:

- Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks; An Information Processing Approach", Elsevier,2007.
- C. S. Raghavendra, Krishna M. Shivalingam, Taieb Znati, "Wireless sensor networks", Springer Verlag.
- H. Edgar, Jr. Callaway, "Wireless Sensor networks, Architectures and Protocols", CRC Press
- Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John wiley & Sons.
- Holger Karl, Andreas Willig, "Protocols and architectures for wireless sensor networks", John wiley & Sons.

CSE-6203 Programming Paradigms							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- Introducing students to functional, logic and concurrent programming paradigms.
- Enabling students to formulate newer abstractions (both procedure and data) in the above paradigms.
- Familiarizing students with writing functional and concurrent programs.
- Preparing students to solve complex real-world problems using appropriate programming paradigms.

Unit I	**15 Lectures**
Object-oriented programming – Fundamentals: Review of OOP - Objects and classes in Java, defining classes, methods, access specifiers, static members, constructors, finalize method. Arrays, Strings, Packages Java Doc comments**.**	
Unit II	**15 Lectures**
Object-oriented programming –Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes – the Object class – Reflection – interfaces – object cloning – inner classes – proxies	
Unit III	**15 Lectures**
Event-driven programming: Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images - Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – introduction to Swing – Model-View- Controller design pattern buttons layout management, Swing Components	
Unit IV	**15 Lectures**
Generic programming : Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics – exceptions – exception hierarchy throwing and catching exceptions – Stack Trace Elements - assertions - logging Concurrent programming : Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – thread-safe Collections – Executors – synchronizers – threads and event-driven programming.	

Course Learning Outcomes (CLOs)

- Understand and apply the concepts that form the basis of functional, logic and concurrent programming paradigms.
- Formulate abstractions with procedures and data in different programming paradigms.
- Write programs in different programming paradigms especially functional, logic and concurrent paradigms.
- Formulate, implement and solve a given problem scenario using appropriate programming paradigm.

Suggested Readings:

- Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, Eighth Edition, Sun Microsystems Press, 2008.
- K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education, 2000.
- Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.
- C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.

IKS-6200 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To equip the students with the knowledge and understanding related to Indian knowledge systems, origin, evolution and the approaches used in ancient and modern times.
- To promote the youths to do research in the various fields of Bhāratīya knowledge system

Unit I- Bhāratīya Civilization and Development of Knowledge System	**8 Lectures**
Genesis of the land, On the trail of the Lost River, Discovery of the Saraswatī River, The Saraswati-Sindhu civilization, Traditional knowledge system, The introduction to Vedas, Main Schools of Philosophy (6+3), Ancient education system, The Takṣaśilā University, The Nālandā University, Alumni, Knowledge export from Bhārata.	
Unit II- Arts, Literature and Scholars	**8 Lectures**
Art, Music, and Dance, Naṭarāja– A masterpiece of Bhāratīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghoṣā, Vālmīki, Patañjali, Vedavyāsa, Yājňavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Kaṇāda, Patañjali, Kauṭīlya, Pāṇini, Thiruvalluvar, Āryabhaṭa, Varāhamihira, Bhāskarācārya, Mādhavācārya	
Unit III- Engineering, Science and Management	**8 Lectures**
Engineering, science and technology in the Vedic Age, Post-Vedic period and Saraswatī-Sindhu civilization, Concept of matter, life and universe, Bhāratīya Kāla-gaṇanā, Concepts of Zero, Pi and number system, Vedic Mathematics, Āyurveda, Astronomy in India, Agriculture in India, Water Management in India, Trades in Ancient India, Seals, Coins and Marine Technology.	
Unit IV-Cultural Heritage and Indian Traditional Practices	**6 Lectures**
Temple architecture in ancient India, Sculptures, Theatre, Drama and Martial arts traditions, Fairs and festivals, Yoga, Integrated approach to healthcare, Approaches and strategies to the protection and conservation of environment.	

Course Learning Outcomes (CLOs)

- The students will be able to understand and appreciate the rich heritage that resides in our traditions.
- The students will be able to improve mindfulness and more maturity leading to an effective process of learning.
- The students will be able to create awareness amongst the youths about the true history and rich culture of the country.

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Suggested Readings:

- Bhag Chand Chauhan, IKS: The Knowledge of Bharata, Garuda Prakashan, 2023.
- Pradeep Kohle et. Al. Pride of India- A Glimpse of India's Scientific Heritage edited by Sanskrit Bharati, 2006.
- Keshav Dev Verma, Vedic Physics, Motilal Banarsidass Publishers, 2012.
- Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd., 2010.
- Sibaji Raha, et al, History of Science in India Volume-1, Part-I, Part-II, Volume VIII, National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata, 2014.

CSE-6206P Programming Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

List of Experiments:

Sr. No.	Name of Experiment
1.	Implementing Classes and Objects
2.	Implementing String Functions
4.	Implementing Thread Methods
5.	Implementing Packages
6.	Design Applet
7.	Implementing Graphic Class Methods
8.	Implementing Interface Methods
9.	Develop an analog clock using applet.
10.	Develop a scientific calculator using swings.

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CSE-6207P AI/ML Lab							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**	**C**	**Internal Assessment**	**End Semester Examination**	**Total**	
0	**0**	**2**	**1**	**Maximum Marks: 40**	**Maximum Marks: 60**	**100**	**3 Hours**
				Minimum Marks: 16	**Minimum Marks: 24**	**40**	

List of Experiments:

Sr. No.	
1.	Write a Program to Implement Breadth First Search.
2.	Write a Program to Implement Depth First Search.
3.	Write a program to implement Hill Climbing Algorithm.
4.	Write a program to implement A* Algorithm
5.	Implementation of Python basic Libraries such as Math, Numpy and Scipy
6.	Implementation of Python Libraries for ML application such as Pandas and Matplotlib
7.	Creation AND loading different datasets in Python.
8.	Write a python program to compute Mean, Median, Mode, Variance and Standard Deviation using Datasets.
9.	Write a program to implement simple Linear Regression and Plot the graph.
10.	Write a program to implement SVM and Plot the graph.

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HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus

for

M.Tech CSE

(SEMESTER-III)

Amended as per NEP-2020

(w.e.f. the Academic Year 2023-2024)

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CSE-7301 Research Methodology							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To introduce the basic concepts in research methodology.
- To address the issues inherent in selecting a research problem and discuss the techniques and tools to be employed in completing a research project.
- To enable the students to prepare report writing and framing Research proposals.

Unit I	**12 Lectures**
Research Design-I: Research: Concept, need, types - basic, applied and action. **Reviewing Literature:** Need, Sources, Purposes and Scope of Review, Steps in conducting review Identifying and defining research problem: Locating, analyzing stating and evaluating problem etc. Method of Research: Descriptive research design-survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research.	
Unit II	**12 Lectures**
Research Design-II: Hypothesis: Meaning, Criteria for constructing hypothesis, Testing Hypothesis and its types. Sampling Techniques: Concept of population and sample, sampling techniques, determining size of sample etc. Design and development of measuring instruments: Tests, questionnaires, checklists, observation, schedules, selecting a standardized test etc. Procedure of data collection, Procedure for writing a research proposal, Procedure for writing a research report etc.	
Unit III	**12 Lectures**
System Simulation & Modeling: System and system environment, components of system, discrete and continuous systems, static and dynamic systems, model of a system, steps required in deriving a model of a system. Verification and validation of simulation model, stochastic nature of the output data. Introduction to Simulation, why and when simulation is an appropriate tool, advantages and disadvantages of Simulation, Areas of application, general steps followed in simulation experiment etc, Factor Analysis: Introduction, Objective and types.	
Unit IV	**12 Lectures**
Statistical analysis through SPSS: Introduction, basic steps of data analysis, SPSS environment, running an analysis, viewing results etc. Quantitative and qualitative analysis techniques, hypothesis testing, chi-square test, t-test, correlation and regression analysis, analysis of variance (ANOVA), choosing appropriate techniques etc. **MATLAB:** Introduction and key features, Workspace, Variables, Numbers, Character strings, Matrices and Arrays (creation, operations and indexing), Expressions, Functions, etc. Control Structures: Loop Control, Conditional Control.	

Course Learning Outcomes (CLOs)

- Ability to understand and comprehend the basics in research methodology and applying them in research/ project work.
- This course will help them to select an appropriate research design.
- With the help of this course, students will be able to take up and implement a research project/ study.
- The course will also enable them to collect the data, edit it properly and analyse it accordingly. Thus, it will facilitate students' prosperity in higher education.

Suggested Readings:

- C.R Kothari and Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International Publishers,2013.
- William M. K. Trochim, "Research Methods", Second Edition, Biztantra Dreamtech Press, 2006.
- Patel R. S, "Research Methodology", Third Edition, Jay Publication, 2019
- W. Borg, M. Gall, "Educational Research: An Introduction", New York, Longman, 2003.
- Wiersma William, "Research Methods in Education- An Introduction", London, Allyn and Bacon, Inc.
- M. N. Borse, "Research Methodology- modern, tools and techniques", Hand Book, Shree Niwas Publications, 2005.
- S. P. Gupta, "Statisitcal Methods", Fourth edition, Sultan Chand & sons, 2011.
- Darren George, Paul Mallery, "SPSS for windows step by step: a simple guide and reference", Allyn & Bacon, Inc.
- B. R. hunt, R. L. Lipsman, J. M. Rosenberg, "A guide to MATLAB for beginners and experienced users", 2E, Cambridge University Press, 2006.
- "MATLAB Primer", The MathWorks, Inc.

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CSE-6106P Research Methodology Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

List of experiments:

Practicals are to be performed of the following topics:

1. Data Preprocessing
2. Plotting data and functions
3. Drawing and Statistical Analysis
4. Typesetting with Latex 2Ɛ
5. Advanced Latex 2Ɛ

Discipline Specific Electives -I

CSE-6211(i) Probability and Statistics with Queuing Theory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

The objective of this course is to provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

Unit I	**15 Lectures**
Probability & mathematical expectations: Introduction to Probability: Definition of Random Experiment – Events and sample space –Definition of probability, Addition and multiplication theorems, Conditional probability, Baye's theorem, Simple problems on Baye's theorem. **Introduction to Random variable**: Discrete and continuous random variables – Distribution function of random variable, Properties, Probability mass function, Probability density function, Mathematical expectation, Properties of mathematical expectation, Moments, moment generating function, Mean and variance.	
Unit II	**15 Lectures**
Probability distributions: Discrete distributions: Binomial distribution – Mean and standard deviations of Binomial distribution – Poisson distribution – Mean and standard deviations of Poisson distribution – Applications. Continuous probability distributions: Uniform distribution – Exponential distribution – Normal distribution – Properties of Normal distribution – Importance of Normal distribution –Area properties of Normal curve.	
Unit III	**15 Lectures**
Curve fitting, correlation and regression: Curve Fitting: Principle of least squares, Method of least squares, Fitting of straight lines, Fitting of second-degree curves and exponential curves. **Correlation:** Definition – Karl Pearson's coefficient of correlation – Measures of correlation – Rank correlation coefficients. **Regression:** Simple linear regression – Regression lines and properties.	
Unit IV	**15 Lectures**
Testing of hypothesis Formulation of Null Hypothesis – Critical region – Level of significance. Small Samples: Students t - distribution (Significance test of a sample mean, Significance test of difference between sample means) –F- distribution – $\chi 2$ - test – Goodness of fit. Large samples: Test of Significance of large samples – Single proportion – Difference between two proportions – Single mean and difference of means. Queuing theory: Queue description – Characteristics of a queuing model – Study state solutions of M/M/1: α Model and M/M/1; N Model.	

Course Learning Outcomes (CLOs)

- Demonstrate basic principles of probability and understand a random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
- Comprehend concepts of discrete, continuous probability distributions and able to solve problems of probability using Binomial, Poisson, Uniform Distribution, Exponential Distribution, Normal distributions.
- Compute simple correlation between the variables and fit straight line, parabola by the principle of least squares.
- Analyze the statistical data and apply various small or large sample tests for testing the hypothesis.
- Understand about different Queuing models and its applications.

Suggested Readings:

- T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw Hill Publications.
- Kishor S. Trivedi, "Probability & Statistics with Reliability, Queuing and Computer Applications", Prentice Hall of India.
- Dr. B.S Grewal, "Higher Engineering Mathematics", Khanna Publishers.
- Sheldon M.Ross, "Probability and Statistics for Engineers and Scientists", Academic Press.
- S C Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics".

CSE-6211(ii) Data Mining							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- Gain an understanding of what data mining is all about.
- Be able to perform the data preparation tasks and understand the implications. • Demonstrate an understanding of the alternative knowledge representations such as rules, decision trees, decision tables, and Bayesian networks.
- Be able to evaluate what has been learned through the application of the appropriate statistics.
- Be able to discuss alternative data mining implementations and what might be most appropriate for a given data mining task.

Unit I	15 Lectures
Data Mining Concepts: - Introduction to modern data analysis (Data visualization; probability; histograms; multinomial distributions), Data Mining and Knowledge Discovery in Data Bases, Data Mining Functionalities, Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation Discretization.	
Unit II	**15 Lectures**
Mining Frequent Patterns, Association, and Correlation: Basic Concepts and Methods: Basic Concepts, Mining Methods, Pattern Evaluation. **Classification:** Basic Concept, Decision Tree Induction, Bayes Classification Methods, Rule Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy.	
Unit III	**15 Lectures**
Classification: Advanced Methods. **Cluster Analysis**: Basic Concepts and Methods, Cluster Analysis, Partitioning Methods, Hierarchical methods.	
Unit IV	**15 Lectures**
Outlier Detection: Outliers And Outlier Analysis, Outlier Detection Methods. **Data Mining Trends:** Mining Complex data, Other Methods of data Mining, Data Mining Applications, Data Mining and Security, Data Mining Trends.	

Course Learning Outcomes (CLOs)

At the end of the course the students will able to:

• Develop an understanding of the data mining process and issues.

• Understand various techniques for data mining

• Apply the techniques in solving data mining problems using data mining tools and systems

• Expose various real-world data mining applications

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Suggested Readings:

- Jiawei han, Micheline Kamber, Jian Pei, " Data Mining: Concepts and techniques", 3rd Edition, Morgan KaufMann imprint of Elsevier.
- Alex Berson,Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata Mcgraw Hill, 2004.
- Jiawei Han. Data Mining: Concepts and Techniques. Morgan Kaufmann Publishers
- Anahory and Murray .,Data warehousing in the real world , Pearson Education / Addison
- Wesley.
- Berry Micheal and Gordon Linoff, Mastering Data Mining. John Wiley & Sons Inc.

CSE-6212(iii) Cloud Computing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

The main objective of this course is to provide conceptual as well as practical knowledge of basic of Cloud Computing, Various Cloud Computing terminologies and Platforms. After completing the course the student should be competent in cloud computing concepts and platforms.

Unit I	**15 Lectures**
Introduction to Cloud Computing: Overview, NIST features, Historical Development, Need for Cloud Computing, Principles of Cloud Computing, Roots of Cloud Computing, Challenges and Risk of Cloud Computing. **Cloud Model:** Cloud Reference Model, Service and Deployment Models, Cloud applications.	
Unit II	**15 Lectures**
Virtualization Technology: Virtualization Structures and Mechanisms, Hypervisor, Full virtualization, Para-virtualization, Hardware Assisted Virtualization, Types of Virtualizations, Creating A Virtual Machine. **Cloud Enable Technologies:** Service Oriented Architecture, Web Technologies, Web Services Specifications, SOAP, REST, XML, JSON, AJAX, MASHUPS: User Interface Services, Multi-Tenancy, Mobile Computing, Sky Computing, Load Balancing.	
Unit III	**15 Lectures**
Big Data: Overview, Need of Big data, Characteristics, Benefits of Big Data Processing, Big Data Technologies, **HADOOP:** Hadoop Architecture, Hadoop Ecosystem, HDFS Architecture , MapReduce , **Cloud Database NoSQL :** Relational, Non-Relational vs. DBaaS Cloud Database, Cloud Database Architectures, Cloud Databases, Amazon Dynamo Database, HBase, Cassandra, Google Big Table, Hive, MongoDB**. Cloud File System:** Google File System (GFS) Vs Hadoop Distributed File System (HDFS)	
Unit IV	**15 Lectures**
Cloud Security: Cloud Information Security Fundamentals, Cloud Security Services, Cloud Security Concerns, Security Challenges, Infrastructure Security, Cloud computing security architecture. **Open Source Clouds Platform:** Case Study on Open Source Clouds Platform, Hadoop, OpenStack, Cloud Stack, Eucalyptus, Open Nebula**. Case Study on Commercial Clouds**: Google App Engine, Microsoft Azure, Amazon, Aneka	

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Course Learning Outcomes (CLOs)

- Basics on what is a learning machine.
- Basic mathematics behind learning algorithms.
- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
- To mathematically analyse various machine learning approaches and paradigms.

Suggested Readings:

- GautamShroff, "Cloud Computing", Cambridge Enterprise.
- Ronald Krutz and Russell "Cloud Security Dean Vines", Wiley-India.
- Tim Malhar, S.Kumara swammy ,"Cloud Security and Privacy" S. Latif(SPD,O'REILLY)
- Antohy T Velte, "Cloud Computing: A Practical Approach", et.al McGraw Hill,
- Barrie Sosinsky, "Cloud Computing Bible" by Wiley India

CSE-6211(iv) Natural Language Processing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

The students should be able to study language and the tools that are available to efficiently study and analyze large collections of text. They should learn about and discuss the effects of electronic communication on our language.

Unit I	**15 Lectures**
Introduction A computational framework for natural language, description of English or an Indian language in the framework, lexicon, algorithms and data structures for implementation of the framework, Finite state automata, the different analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.	
Unit II	**15 Lectures**
Word level and syntactic analysis Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. -- Syntactic Analysis: Context Machine free Grammar, Constituency, Parsing readable dictionaries and lexical databases, RTN, ATN.	
Unit III	**15 Lectures**
Semantic analysis Probabilistic Parsing. Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.	
Unit IV	**15 Lectures**
Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.	

Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- Develop speech-based applications that use speech analysis (phonetics, speech recognition, and synthesis).
- Analyse the syntax, semantics, and pragmatics of a statement written in a natural language.
- Develop a conversational agent that uses natural language understanding and generation.

Suggested Readings:

- Natural Language understanding by James Allen, Pearson Education, 2002.
- NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.
- Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
- An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
- Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley.
- https://www.coursera.org/specializations/natural-language-processing

Discipline Specific Electives -II

CSE-6212(i) Distributed Database Management System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To provide conceptual as well as practical knowledge of Database, various methodologies and applications software used for data base management.
- To become competent in data base handling, able to design and manage database for real life problems and
- the student should by proficient in query handling.

Unit I	15 Lectures

Distributed Data Processing: Introduction, Fundamentals of Distributed Data Base Management System (Transparent management of distributed & replicated data, Reliability, Improved performance, System expansion), Disadvantages of Distributed Data Base Management System (Complexity, Cost, Distribution of control, Security, Distributed database design, Query processing, Directory Mgmt, concurrency control, Deadlock Mgmt, Reliability, OS support, Heterogeneous databases, Relationship).
Relational Data Base Management System: Basic Concepts, Data Modeling for a Database, Records and Files, Abstraction and Data Integration, The Three-Level Architecture Proposal for DBMS, Components of a DBMS, Advantages and Disadvantages of a DBMS. Data Models, Data Associations, Data Models Classification, Entity Relationship Model, Relational Data Model. Normalization: Dependency structures,Normal forms.

Unit II	15 Lectures

Distributed Data Base Management System Architecture: Architectural models for distributed DBMS (Autonomy, Distribution, Heterogeneity, Architectural alternatives), Client/server systems, Peer-to-peer Distributed Systems.
Distributed Database Design: Design Strategies (Top-Down Design & Bottom-Up design process), Design issues (reasons for fragmentation, alternatives, Degree & Correctness rules of fragmentation, Allocation alternatives, Information requirement. Fragmentation: Horizontal, Vertical, Hybrid Fragmentation. Allocation: Problem, Information requirement, Allocation model, Solution methods.

Unit III	15 Lectures

Query Processing: Problem, objectives, Complexity of Relational Algebra operations, Characterization of query processing (Language, Types of Optimization, Optimization timing, Statistics, Decision sites, Exploitation of network topology & Replicated fragments, Use of semijoins), Layers of Query processing (Query decomposition, Data localization, Global & Local query optimizations).
Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanism, Locking based concurrency control algorithm (centralized 2pl, primary copy 2pl, distributed 2pl), Timestamp based concurrency control algorithm (conservative & multiversion TO algorithm), Optimistic concurrency control algorithm, Deadlock management, prevention, avoidance, detection & resolution.

Unit IV	15 Lectures
Distributed DBMS Reliability: Reliability concepts & measures (system, state & failures, reliability & availability, mean time between failures/repair), Failures & fault tolerance in distributed system (reason for failures, fault tolerance approaches & techniques), Failures in Distributed DBMS (transaction, system, media & communication failure), Local reliability protocols (architectural considerations, recovery, information execution of LRM commands, checkpointing, handling media failure), Distributed ReliabilityProtocols (Components, Two-Phase commit protocol, Variation of 2PC).	

Course Learning Outcomes (CLOs):

- The candidate will get knowledge of: - Query optimization. - Parallel and distributed database systems. New database architectures and query operators.
- Ability to develop new methods in databases based on knowledge of existing techniques.
- Ability to apply acquired knowledge for developing holistic solutions based on database systems/database techniques.

Suggested Readings:

- M. Tamer Ozsu & Patrick Valduriez, "Principles of Distributed Database Systems", Pearson EducationAsia.
- Desai, B., "An Introduction to Database Concepts." Galgotia Publications, New Delhi.
- Date C.J., "An Introduction to Database Systems", Narosa Publishing House, New Delhi.
- Elimsari and Navathe, "Fundamentals of Database Systems", Addison Wesley, New York.

CSE-6212(ii) Formal Languages and Automata Theory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- Introduce concepts in automata theory and theory of computation.
- Identify different formal language classes and their relationships.
- Design grammars and recognizers for different formal languages
- Prove or disprove theorems in automata theory using its properties.
- Determine the decidability and intractability of computational problems.

Unit I	15 Lectures
Finite Automata and Regular Expression: Finite State System, Basic Definition, Deterministic and Non- Deterministic Finite Automata (Only Definition), Finite Automata with Output, Regular Expression. **Turing Machines:** Definition Of Various Version Of Touring Machines, Deterministic, Non- Deterministic, Two-Way, Infinite Tape, Multi Tape, Multi Head, Statements Of Their Equivalence (Without Proof), Construction Of Turing Machines (Any Model) For Log N; N!, N2.	
Unit II	**15 Lectures**
Context Free Grammars: Context Free Grammars, Derivation Trees, Simplification of Context-Free Grammars, Chomsky Normal Form, Greibach Normal Form. Properties Of Context -Free Languages: The Pumping Leema For CFL'S Closure Properties Of CFL'S , Decision Algorithms For CFL'S.	
Unit III	**15 Lectures**
Introduction To Compiling: Compilers, Analysis of Source Program, The Phases of A Compiler, One Pass Compiler, Overview, Syntax Definition, Syntax-Directed Translation, Parsing, Lexical Analysis, Role of The Lexical Analyzer. Syntax Analysis, The Role of Parser, Context Free Grammars, Writing A Grammer, Top-Down Parsing (Recursive-Descent Parsing, Predictive Parsing, Transition Diagram For Predictive Parsing.	
Unit IV	**15 Lectures**
Non Recursive Predictive Parsing, First And Follow, Ll(1) Grammers, Error Recovery In Predictive, Parsing . Bottom-Up Parsing: Handles, Handle Pruning, Stack Implementation In Shift Reduce Parsing, Conflicts In Shift Reducing Parsing, LR-Parsers, LR Algorithm, LR Grammars, Constructing SLR Parsing Tables, Using Ambiguous Grammars, Error Recovery In LR Parsing.	

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Course Learning Outcomes (CLOs):

- Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
- An ability to design grammars and automata (recognizers) for different language classes.
- An ability to identify formal language classes and prove language membership properties.
- An ability to prove and disprove theorems establishing key properties of formal languages and automata.
- Acquire a fundamental understanding of core concepts relating to the theory of computation and computational models including (but not limited to) decidability and intractability.

Suggested Readings:

- Johan E. Hopcroft, Jeffery D. Ullman, "Introduction To Automata Theory Languages Computation", Narosa Publishing House.
- Alfred V.Aho, Ravi Sethi, Jeffery D. Ullman, "Compilers Principles, Techniques and Tools", Addison-Wesley Publishing Company.
- William A. Barrett, Bates, John D. Couch", Compiler Construction Theory and Practical.

CSE-6212(iii) Data Analytics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

Discuss various concepts of data analytics pipeline. Discuss and apply various data analytics methods. Discuss and apply text and sentiment analysis. Apply R tool for Data Analytics problem solving. Understand NoSQL and Data Visualisation methods and implementation in tool.

Unit I	**15 Lectures**
Introduction: Data, Types of Data, Big Data, Big data Characteristics, Business Intelligence, Levels of measurement, Introduction to Statistical Learning, Mean, Median, Mode, Standard deviation. Life cycle of Data centric projects.	
Unit II	**15 Lectures**
Basic Analysis Techniques: Chi-Square, t-Test, Correlation Analysis, Analysis of Variance. Advanced Analytics Techniques: Regression, Clustering, Classification, Association Mining.	
Unit III	**15 Lectures**
Text Analytics & Web Mining: Process of Text Analytics, Topic Modelling, Sentiment Analysis, Web Mining. Time Series Analysis: Overview of Time Series Analysis, Forecasting Models, ARMA and ARIMA Models	
Unit IV	**15 Lectures**
R language: Introduction to R., Basic Syntax, Implementation basic and advanced Data analytic methods, Data visualization using R, Text Analysis Process in R. No SQL: Introduction to No SQL, Principles of No SQL Data Models, CAP, No SQL Data Model.	

Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- Understand Big Data and its analytics in the real world
- Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm
- Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics

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Suggested Readings:

- Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
- An and Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
- Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and
- Analytic Trends for Today's Businesses", Wiley
- David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley
- Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication
- Glenn J. Myatt, Making Sense of Data, John Wiley& Sons
- Jiawei Han, Miche line Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier
- Scientific Articles published in International Journals and Conferences related to Data Analytics

CSE-6212(iv) Soft Computing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide students hand-on experience on MATLAB to implement various strategies

Unit I	**15 Lectures**
Introduction: Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.	
Unit II	**15 Lectures**
Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	
Unit III	**15 Lectures**
Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.	
Unit IV	**15 Lectures**
Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition. Recent Trends in deep learning, neural networks and genetic algorithm	

Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

Suggested Readings:

- Jyh, Shing Roger Jang, Chuen, Tsai Sun, Eiji Mizutani, Neuro: Fuzzy and Soft Computing, Prentice: Hall of India, 2003.
- George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.

Inter Departmental Electives

CSE ID-6201(i) Mobile Computing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

Students taking this course will develop an understanding of the ways that mobile technologies can be used for teaching and learning. They will also consider the impact of mobile computing on the field of education.

Unit I	**8 Lectures**
Detailed Introduction of Mobile Computing: History, Types, Benefits, Application, Evolution, Security Concern regarding Mobile Computing, Different Propagation Modes, Wireless Architecture and its types, needs of mobile user	
Unit II	**8 Lectures**
The cellular concept: Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio	
Unit III	**8 Lectures**
Wireless Application Protocol: Introduction of WAP, WAP applications, WAP Architecture, WAP Protocol Stack, Challenges in WAP	
Unit IV	**6 Lectures**
Introduction to 4G: Introduction, features and challenges, Applications of 4G, 4G network architecture	

Course Learning Outcomes (CLOs)

After completion of this course, student will be able

- To understand concepts of Mobile Communication.
- To analyse next generation Mobile Communication System.
- To understand network and transport layers of Mobile Communication.
- Analyze various protocols of all layers for mobile wireless communication networks.

Suggested Readings:

- Mobile ComputingTechnology,Applications and service creation ,Asoke K Telukder, Roopa R Yavagal by TMH.
- Mobile Computing,Raj Kamal by Oxford
- Wireless Communications & Networks, Second Edition,William Stallings by Pearson
- Mobile Computing Theory and Practice-Kumkum Garg-Pearson
- TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition,TMH

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CSE ID-6201(ii) Data Storage Technologies and Networks							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

to provide learners with a basic understanding of Enterprise Data Storage and Management Technologies

Unit I	**8 Lectures**
Storage Media and Technologies – Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.	
Unit II	**8 Lectures**
Usage and Access – Positioning in the Memory Hierarchy, Hardware and Software Design for Access, Performance issues.	
Unit III	**6 Lectures**
Storage Architecture - Storage Partitioning, Storage System Design, Caching, Legacy Systems.	
Unit IV	**8 Lectures**
Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. **Storage QoS**–Performance, Reliability, and Security issues.	

Course Learning Outcomes (CLOs)

After completion of course, students would be:

- Learn Storage System Architecture
- Overview of Virtualization Technologies, Storage Area Network

Suggested Readings:

- The Complete Guide to Data Storage Technologies for Network-centric Computing Paperback–Import, Mar 1998 by Computer Technology Research Corporation
- Data Storage Networking: Real World Skills for the CompTIA Storage by Nigel Poulton

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CSE ID-6201(iii) OBJECT ORIENTED TECHNIQUES							
Teaching Scheme			**Credit**	**Marks Distribution**			**Duration of End Semester Examination**
L	**T**	**P**	**C**	**Internal Assessment**	**End Semester Examination**	**Total**	
2	**0**	**0**	**2**	**Maximum Marks: 40**	**Maximum Marks: 60**	**100**	**3 Hours**
				Minimum Marks: 16	**Minimum Marks: 24**	**40**	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To Introduce various designing techniques and methods for object oriented
- Performance analysis with real time system
- Demonstrate a familiarity with object-oriented data and system.
- To give clear idea on implementing design with UML diagram like state diagram, activity diagram, use case diagram etc.

Unit I	**8 Lectures**
Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling	
Unit II	**8 Lectures**
C++ Basics: Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures **C++ Functions:** Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	
Unit III	**6 Lectures**
Objects and Classes: Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion.	
Unit IV	**8 Lectures**
Inheritance: Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class. **Polymorphism:** this pointer, virtual and pure virtual functions, Implementing polymorphism	

Course Learning Outcomes (CLOs)

- Develop modular solutions to a given problem statement
- Design and implement software employing the principles of encapsulation, information hiding, abstraction, and polymorphism
- Design, implement, and use classes and methods in an object-oriented programming language

Suggested Readings:

- James Rumbaugh et. al, “Object Oriented Modeling and Design”, PHI
- Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education
- Object Oriented Programming With C++, E Balagurusamy, TMH
- R. S. Salaria, Mastering Object Oriented Programming with C++, Khanna Publishing House

CSE ID-6201(iv) Steganography and Digital Watermarking							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

The objective of course is to provide a insight to steganography techniques. Watermarking techniques along with attacks on data hiding and integrity of data is included in this course.

Unit I	**8 Lectures**
Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Steganalysis: Active and Malicious Attackers, Active and passive steganalysis	
Unit II	**8 Lectures**
Frameworks for secret communication (pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive),	
Unit III	**8 Lectures**
Steganography techniques: Substitution systems, Spatial Domain, Transform domain techniques, Spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools: EzStego, FFEncode, Hide 4 PGP, Hide and Seek, S Tools etc.)	
Unit IV	**6 Lectures**
Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based	

Course Learning Outcomes (CLOs)

• Learn the concept of information hiding.
• Survey of current techniques of steganography and learn how to detect and extract hidden information.
• Learn watermarking techniques and through examples understand the concept.

Suggested Readings:

- Peter Wayner, "Disappearing Cryptography–Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.
- Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, "Digital Watermarking and Steganography", Margan Kaufmann Publishers, New York, 2008.
- Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, ZoranDuric, SushilJajodia
- Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A. P. Petitcolas

Discipline Specific Electives -III

CSE-7311(i) Cryptography & Network Security							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of data.
- To understand various protocols for network security to protect against the threats in the networks.

Unit I	**15 Lectures**
Introduction to Cryptography and Block Ciphers, security attacks - services and mechanism - Conventional Encryption: Conventional encryption model - classical encryption techniques -substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES.	
Unit II	**15 Lectures**
Confidentiality and Modular Arithmetic: Confidentiality using conventional encryption – traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms. Public key cryptography and Authentication requirements: Principles of public key crypto systems - RSA algorithm - security of RSA - key management –Diffle-Hellman key exchange algorithm	
Unit III	**15 Lectures**
Introductory idea of Elliptic curve cryptography –Elgamel encryption - Message Authentication and Hash Function: Authentication requirements -authentication functions - message authentication code - hash functions - birthday attacks –security of hash functions and MACS.	
Unit IV	**15 Lectures**
Integrity checks and Authentication algorithms:MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME, IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management.	

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Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- Provide security of the data over the network.
- Do research in the emerging areas of cryptography and network security.
- Implement various networking protocols.
- Protect any network from the threats in the world.

Suggested Readings:

- William Stallings, “Cryptography and Network security Principles and Practices”,
- Pearson/PHI.
- Wade Trappe, Lawrence C Washington, “Introduction to Cryptography with coding
- theory”, Pearson.
- W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
- Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

CSE-7311(ii) Cyber Security

Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

To give students an extensive overview of cyber security issues, tools and techniques that are critical in solving problems in cyber security domains.

To provide students with concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques.

Unit I	**15 Lectures**
Cyber Security Concepts: Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning). Open Source/ Free/ Trial Tools: nmap, zenmap, Port Scanners, Network scanners.	
Unit II	**15 Lectures**
Cryptography: Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types Of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- pGp and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.	
Unit III	**15 Lectures**
System Security: Server Security, OS Security, Physical Security, Introduction to Networks, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Vulnerabilities and Attacks. Intrusion detection and Prevention Techniques, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.	
Unit IV	**15 Lectures**
Internet Security: Cloud Computing and Security, Social Network sites security, Cyber Security Vulnerabilities-overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment.	

Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- Students will communicate effectively both orally and in writing in a variety of audiences.
- Students will demonstrate critical thinking by analyzing situations and by constructing and selecting solutions to problems.

- Students will understand and appreciate the legal and ethical environment impacting individuals as well as business organizations and have an understanding of the ethical implications of IT legal decisions.
- Students will have a fundamental knowledge of Information Technologies which affect organizational processes and decision-making.

Suggested Readings:

- William Stallings, "Cryptography and Network Security', Pearson Education/PHl, 2006.
- V.K. Jain, "Cryptography and Network Security", Khanna Publishing House. 3. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi Reference Books:
- Atul Kahate, "Cryptography and Network Security", McGraw Hill.
- V.K. Pachghare, "Cryptography and Information Security", PHI Learning
- Nina Godbole, "Information System Security", Wiley

CSE-7311(iii) Cyber Forensics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To identify, gather, and preserve the proof of a law-breaking.
- To track and prosecute the perpetrators in an exceedingly court of law.
- To interpret, document and gift the proof to be permissible throughout prosecution.
- To estimate the potential impact of a malicious activity on the victim and assess the intent of the offender.

Unit I	15 Lectures
Cyber Crime and computer crime : Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules.	
Unit II	**15 Lectures**
Cyber Forensic and Computer Crimes – I : Introduction , Conventional Crime , Cyber Crime, Reasons for Cyber Crime, Classification of Conventional and Cyber Crime, Distinction between Conventional and Cyber Crime, Cyber Criminal Mode and Manner of Committing Cyber Crime, Computer Crime Prevention Measures, Crimes targeting Computers, Unauthorized Access, Packet Sniffing, Malicious Codes including Trojans, Viruses, Logic Bombs, etc.	
Unit III	**15 Lectures**
Provisions in Indian Laws – I : Provisions in Indian Laws , Penalties Under IT Act , Offences Under IT Act ,Establishment of Authorities under IT Act and their functions, powers, Controller, Certifying Authorities ,Cyber Regulation Appellate Tribunal ,Adjudicating officer	
Unit IV	**15 Lectures**
Forensic Tools and Processing of Electronic Evidence : Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	

Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- Understand the basic terminology of cybercrimes
- Apply a number of different computer forensic tools to a given scenario Implement various networking protocols.
- Analyze and validate digital evidence data
- Analyze acquisition methods for digital evidence related to system security

Suggested Readings:

- Dejay, Murugan, Cyber Forensics Oxford university press India Edition, 2018.
- CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
- .http://www.cyberforensics.in/
- https://evestigate.com/computer-forensics-links/

CSE-7311(iv) Data Security and Access Control							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Guidelines for setting Question Paper: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives (COs)

- To provide fundamentals of database security.
- To provide various access control techniques mechanisms were introduced along with application areas of access control techniques.

Unit I	**15 Lectures**
Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non-Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.	
Unit II	**15 Lectures**
Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.	
Unit III	**15 Lectures**
Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.	
Unit IV	**15 Lectures**
Smart Card based Information Security, Smart card operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.	

Course Learning Outcomes (CLOs)

After successful completion of the course, the learners would be able to

- In this course, the students will be enabled to understand and implement classical models and algorithms
- They will learn how to analyse the data, identify the problems, and choose the relevant models and algorithms to apply.
- They will further be able to assess the strengths and weaknesses of various access control models and to analyse their behaviour.

Suggested Readings:

- Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli.
- http://www.smartcard.co.uk/tutorials/sct-itsc.pdf : Smart Card Tutorial.

Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP